

Airborne Sunphotometry in the Second SAGE III Ozone Loss & Validation Experiment (SOLVE II)



Science Team for Ames Airborne Tracking Sunphotometer (AATS-14) in SOLVE II:

Phil Russell¹, PI

John Livingston², Beat Schmid³, and Jens Redemann³, Co-Is

Jim Eilers¹, Engineer

Ric Kolyer¹, Technician

Stephanie Ramirez³, Programmer/Analyst

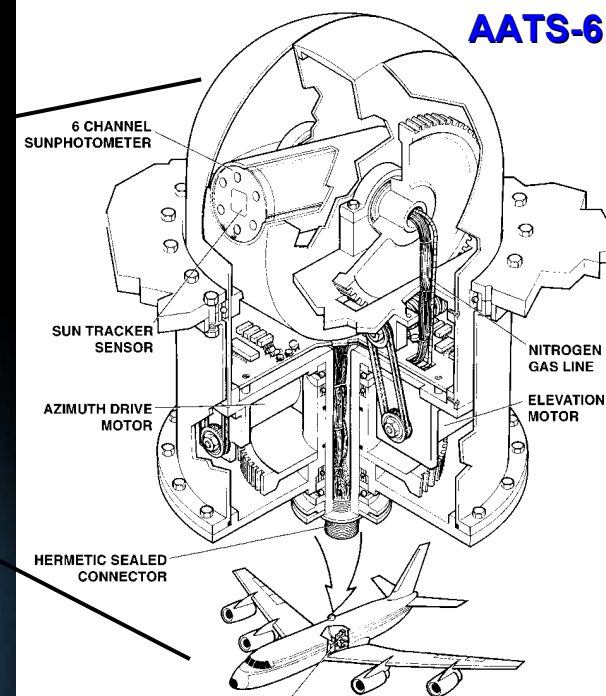
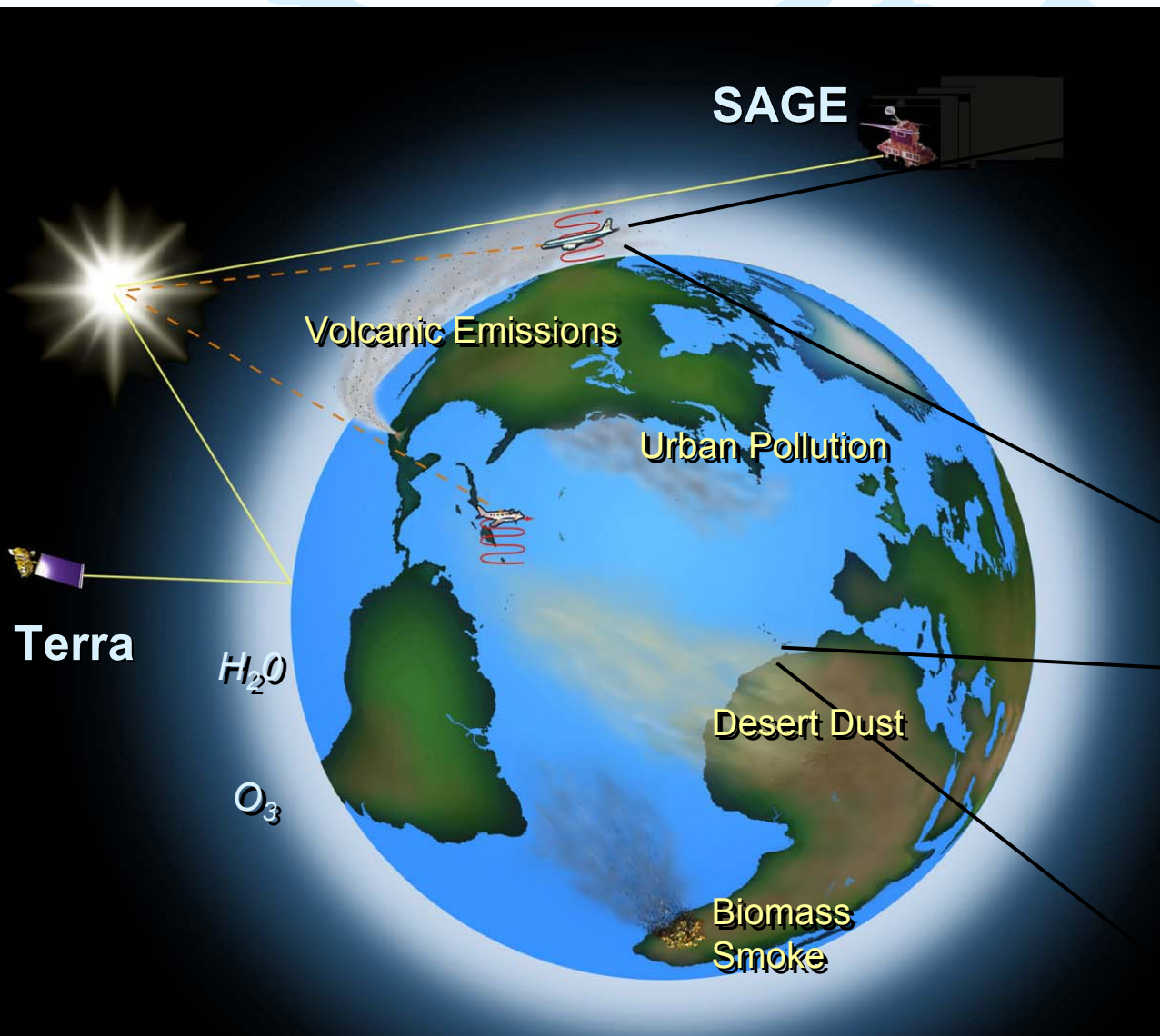
¹NASA Ames Research Center, Moffett Field, CA

²SRI International, Menlo Park, CA

³Bay Area Environmental Research Institute, Sonoma, CA

**SOLVE II Pre-Mission Science Team Meeting
Dryden Flight Research Center, Edwards, CA, December 11, 2002**

Ames Airborne Tracking Sunphotometers (AATS) And How They Are Used



Goals



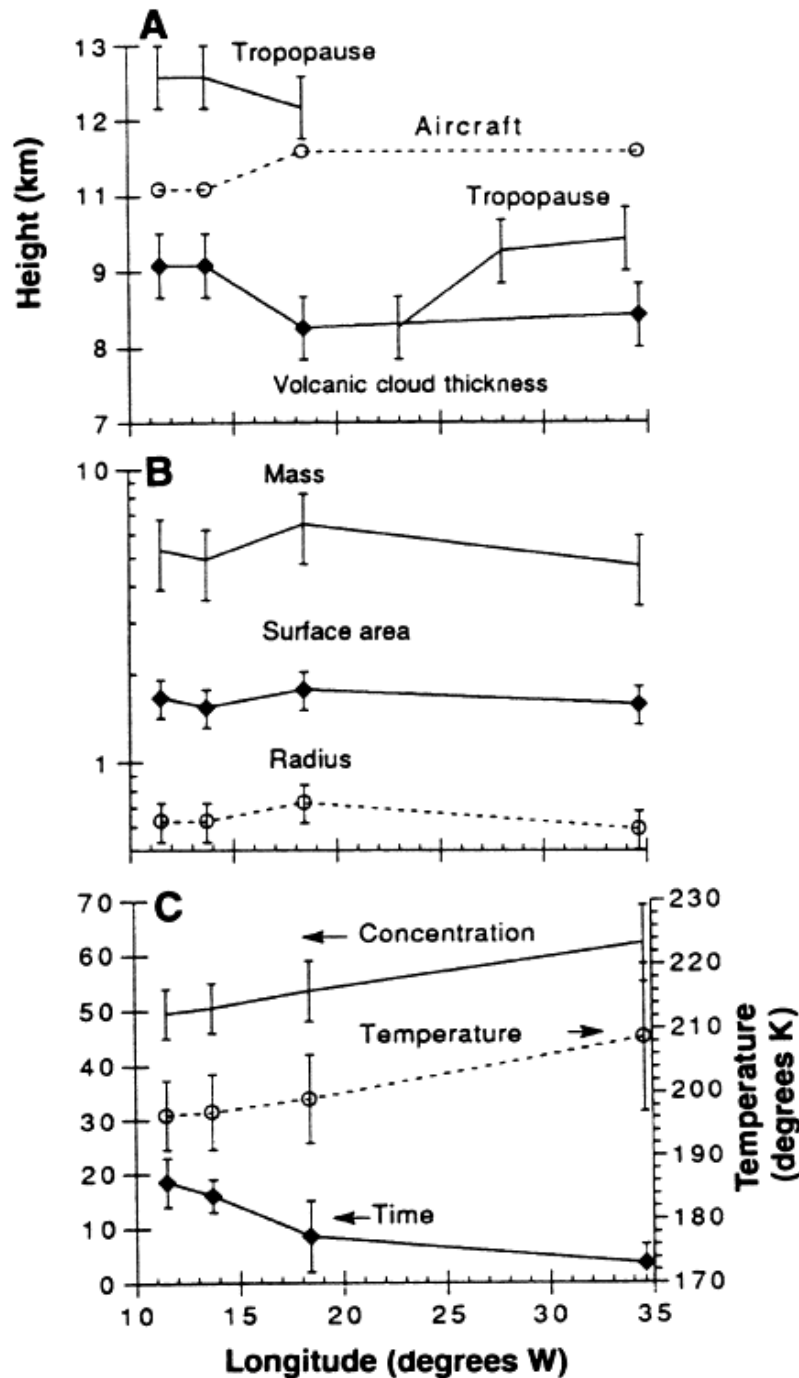
• SOLVE II Proposal: Provide measurements to validate SAGE

III

- Aerosol & PSC Optical Depth Spectra (380-1558 nm)**
- Ozone Column**
- Water Vapor Column**
- Vertical Profiles of Above When DC-8 Flies Profiles**

• SOSST Proposal:

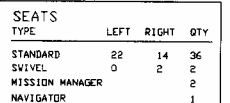
- In-depth validation studies using SOLVE-2 data**
- Derive aerosol and PSC particle size distributions, surface areas and volumes, for use in studies of the heterogeneous chemical processes that control ozone concentrations**
- Radiative effects of PSCs and other aerosols**



(A) DC-8 altitude, tropopause altitude, and thickness of Pinatubo volcanic aerosol layer measured by DC-8 lidar.

(B) Aerosol column mass ($\mu\text{g cm}^{-2}$), column surface area ($\mu\text{m}^2 \text{ cm}^{-2} \times 10^7$) and particle effective radius (μm), all determined from DC-8 sunphotometer optical depth spectra.

(C) Particle sulfuric acid concentration W (% by weight), temperature (K) vertical average above the aircraft, and time (h) spent on trajectories with $W < 60\%$. Error bars denote extreme values over the altitude region of the volcanic aerosol layer (Toon et al., *Science*, 1993).



NOTE:
REFLECTION TAPE REQUIRED
ON ENGINE #4 COILING FOR ILW
WATER VAPOR LASER

Goals



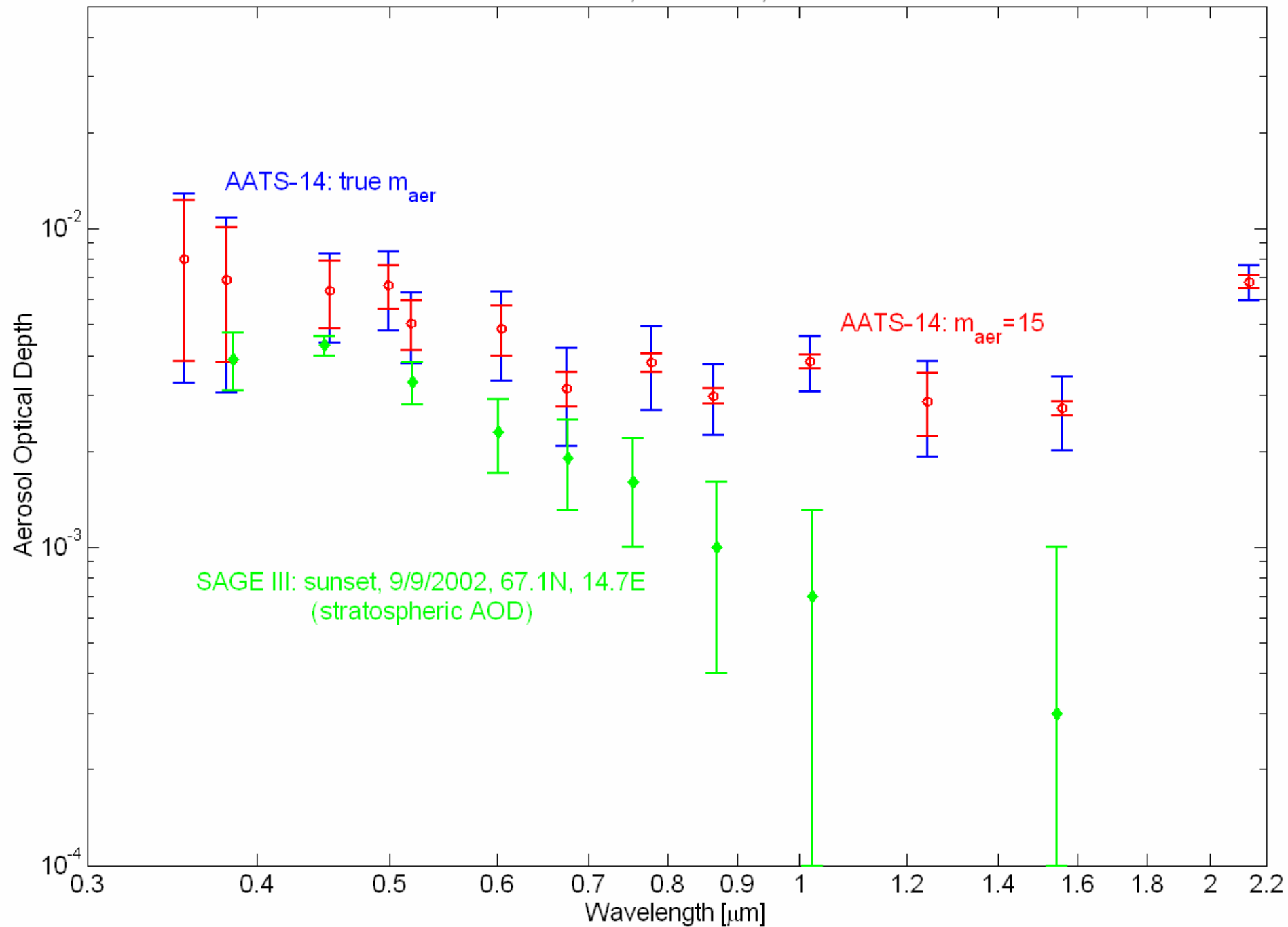
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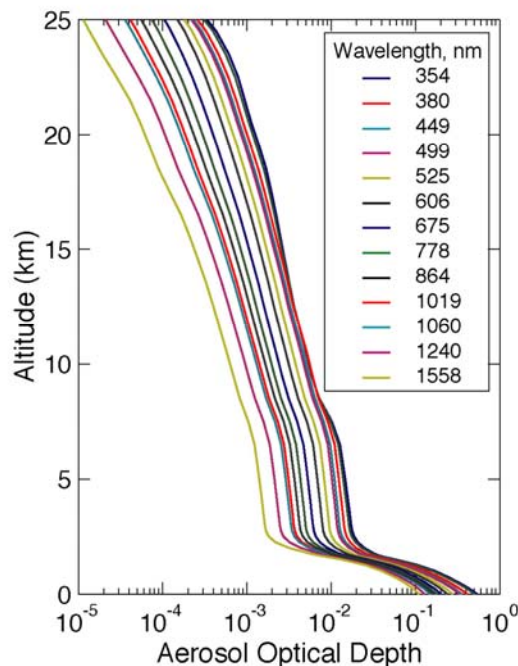
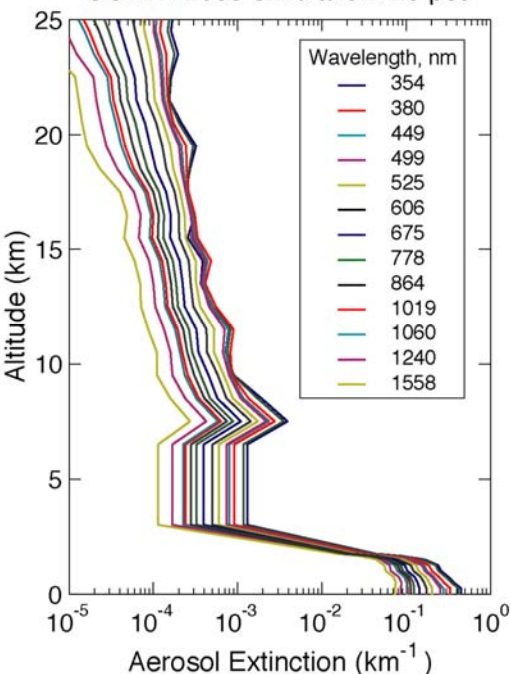
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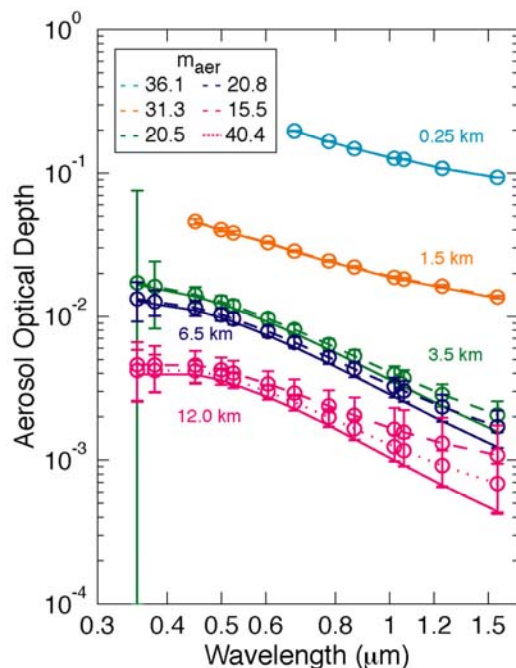
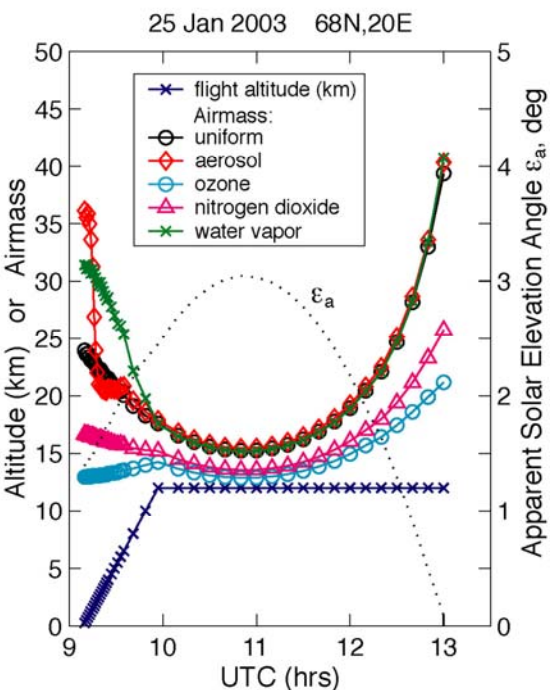
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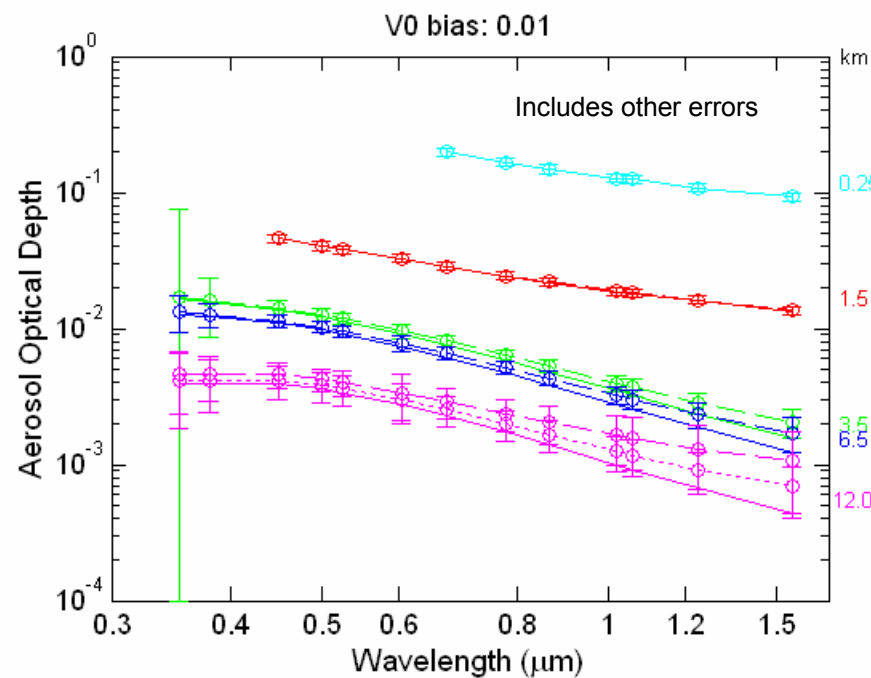
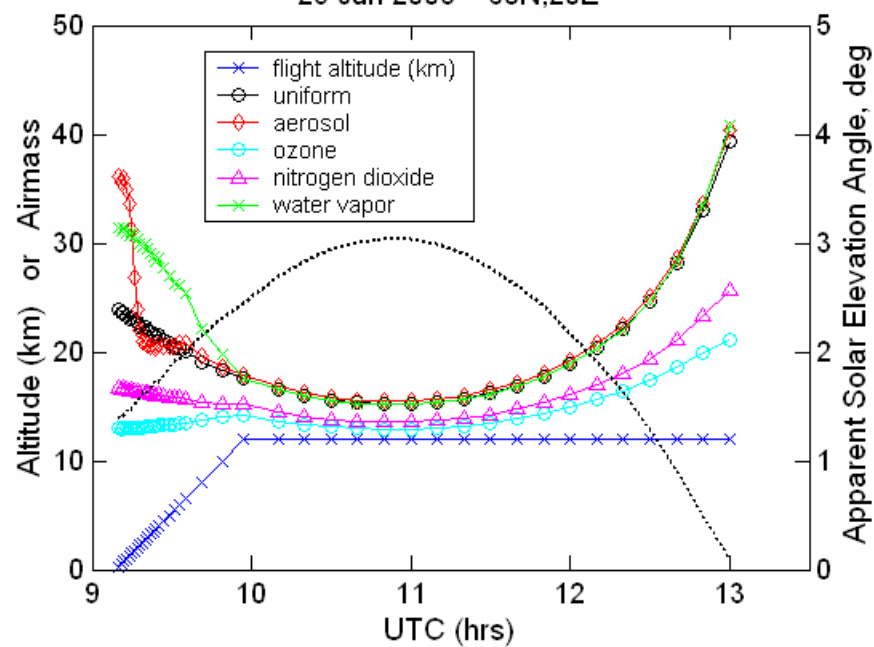
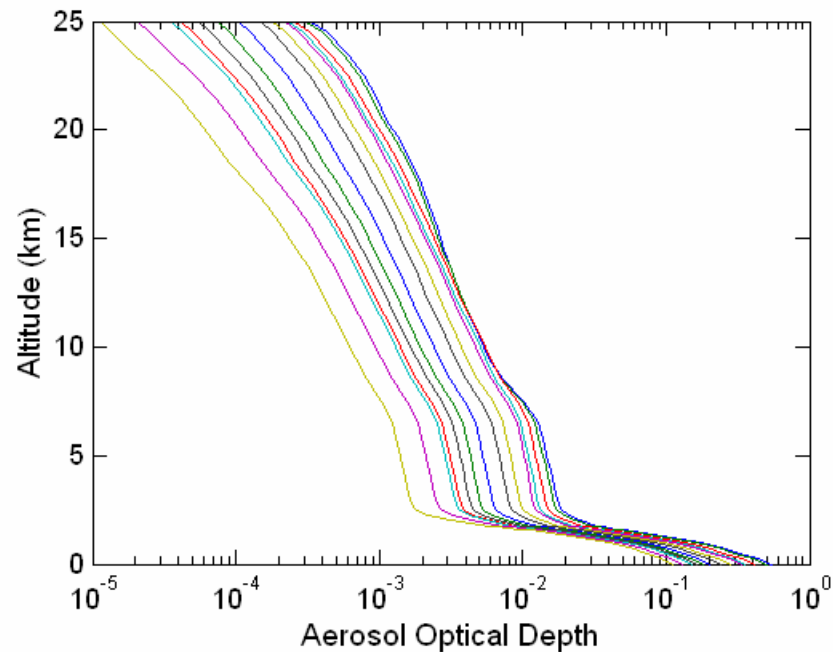
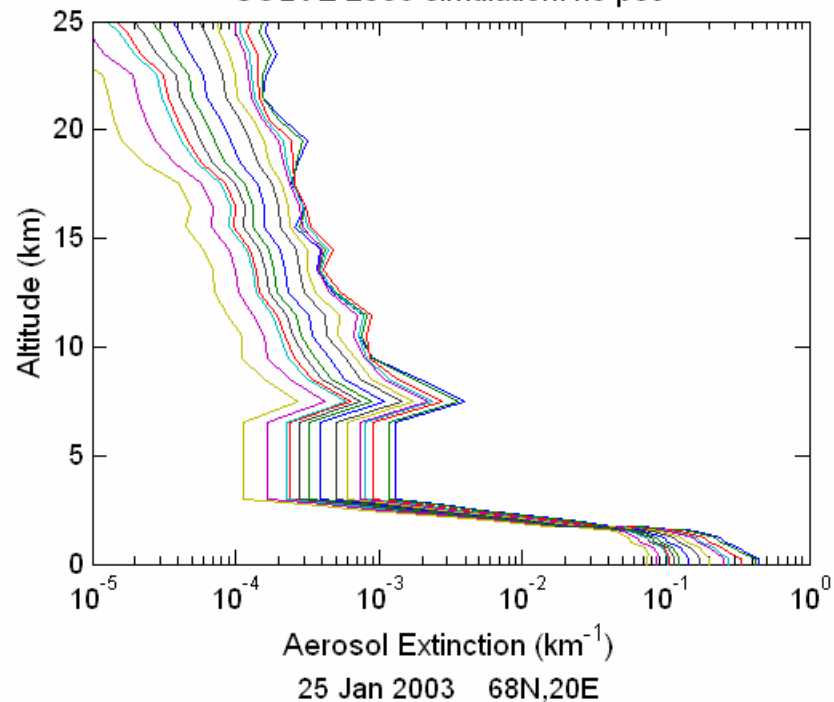
(a,b) Model profiles of stratospheric and tropospheric aerosol extinction and optical depth based on SAGE II and AATS-14 measurements.

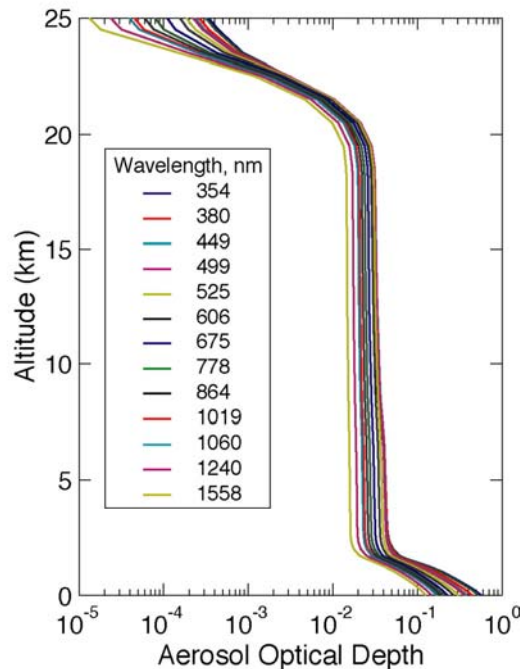
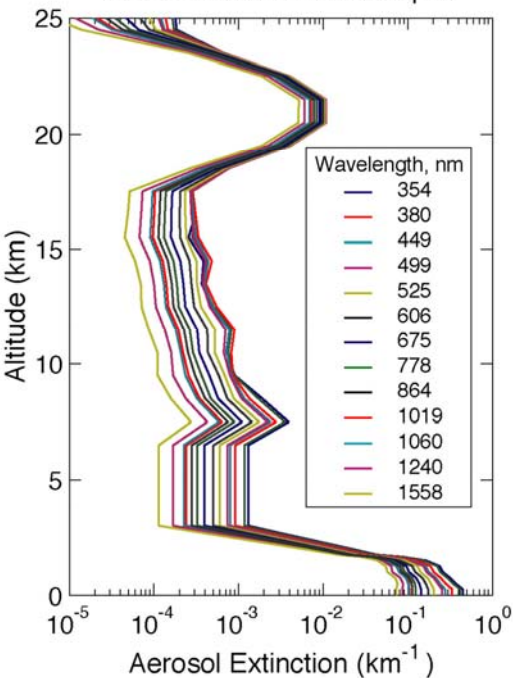
(c) Profile of a simulated flight at 68N, 20E on January 25, 2003 with corresponding airmass values for Rayleigh, ozone, aerosol, water vapor, and NO_2 .



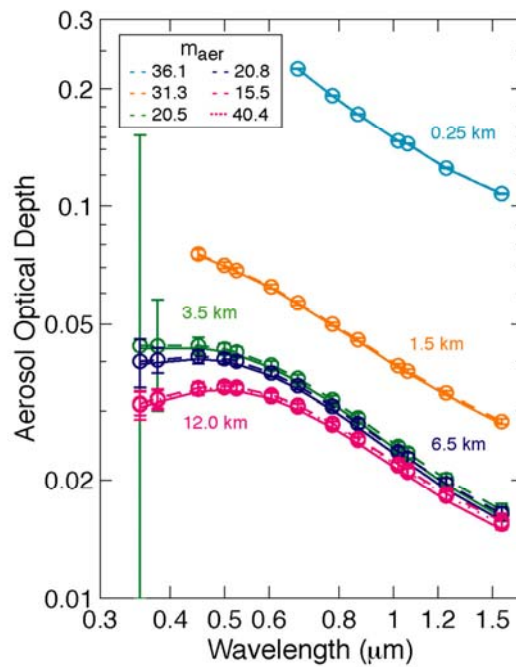
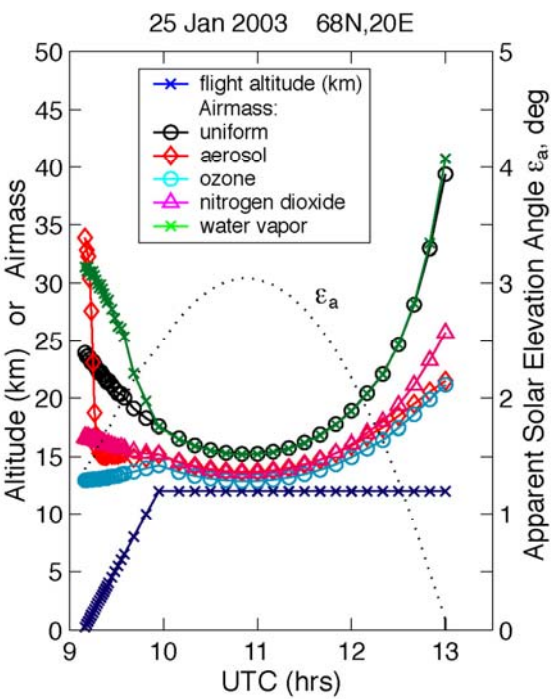
(d) Simulated measurements of optical depth spectra (dashed lines and symbols with error bars) with the model spectra (solid lines) used to compute them.

SOLVE 2003 simulation: no psc

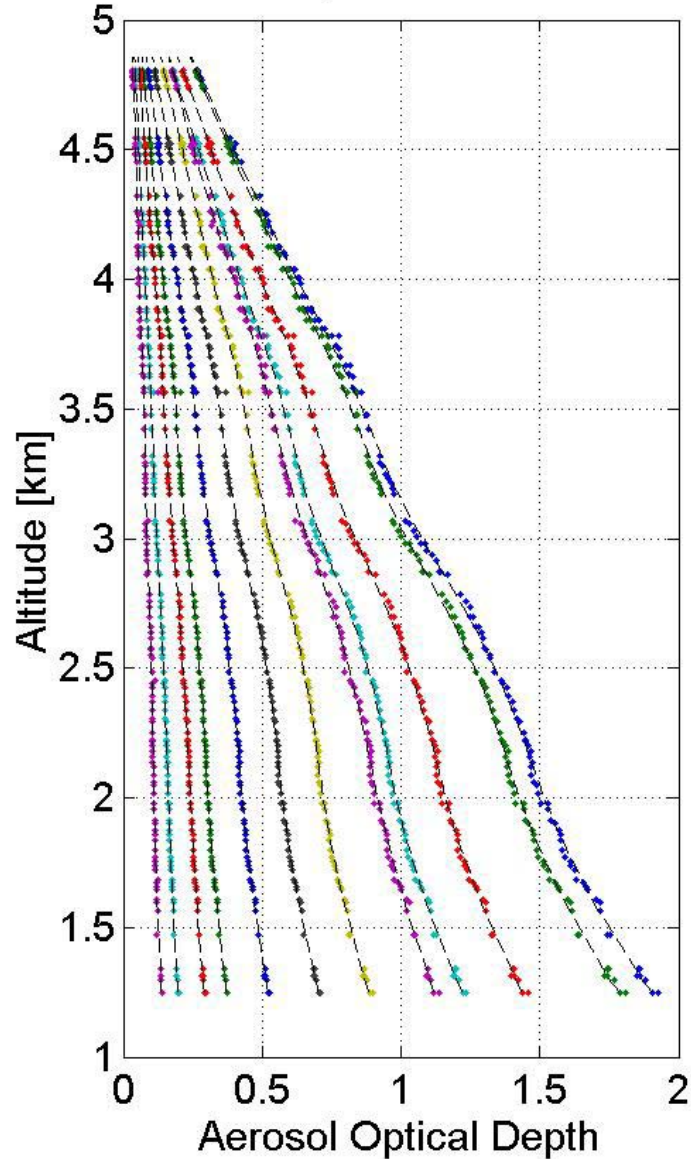




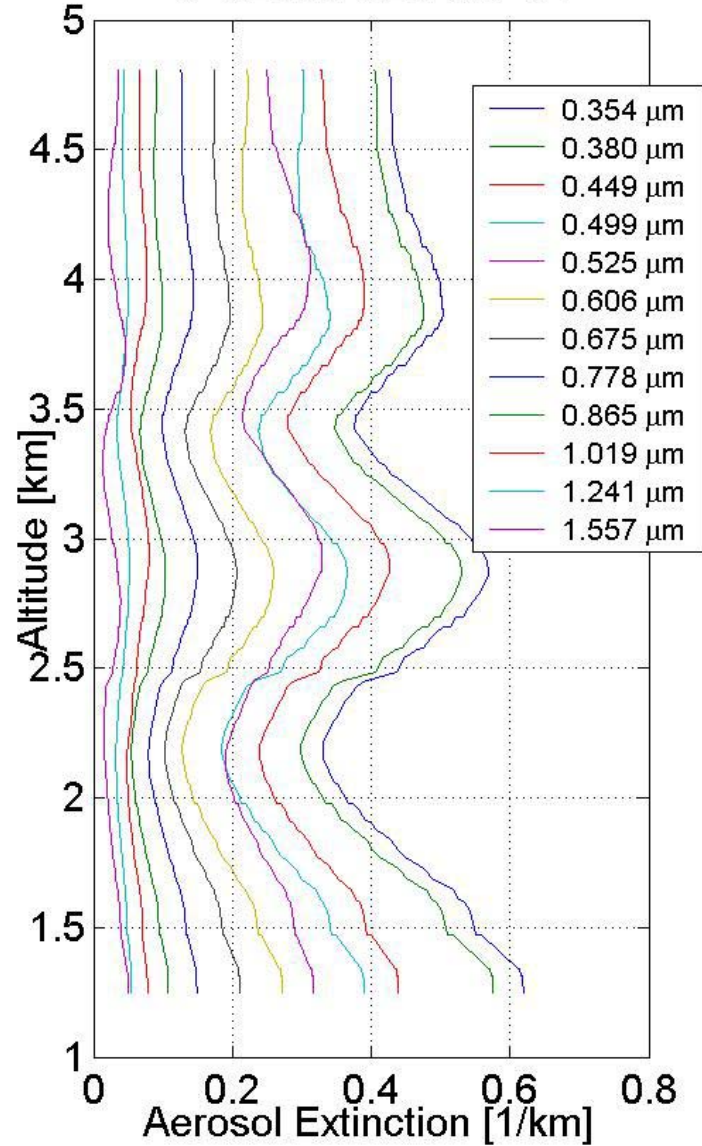
**Measurement simulation
analogous to previous,
but for a POAM-measured
PSC
with $\tau(500 \text{ nm})=0.02$.**



NASA Ames Sunphotometer SAFARI-2000



9/ 6/2000 9.28-9.5 UT



Goals



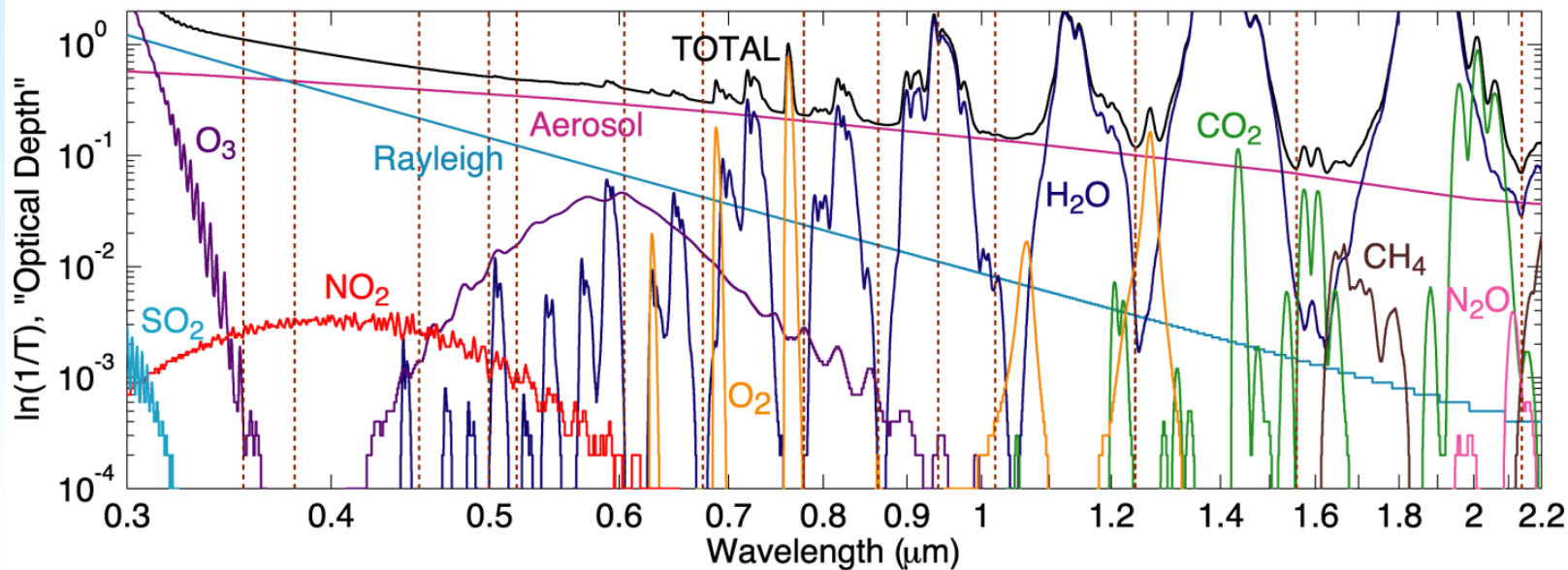
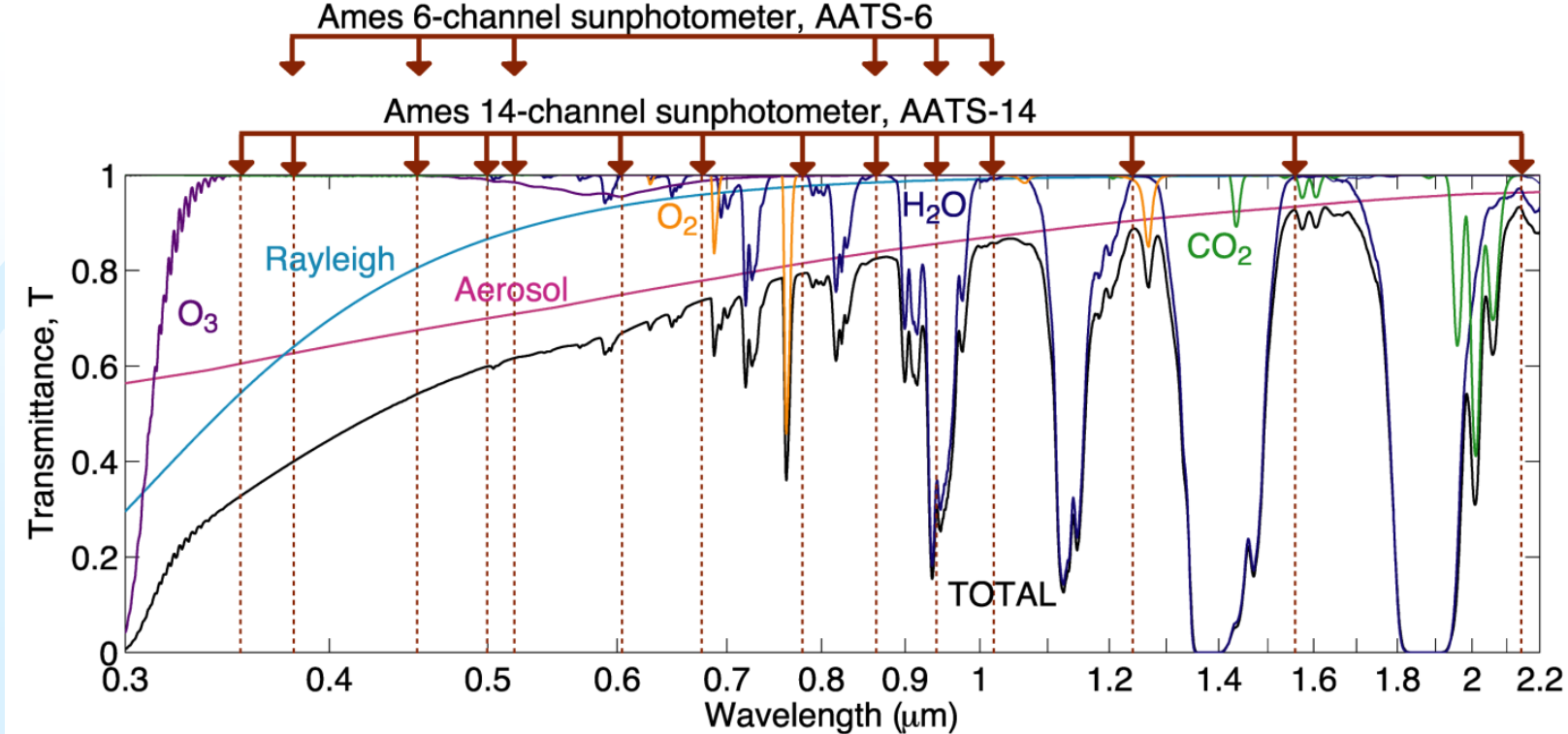
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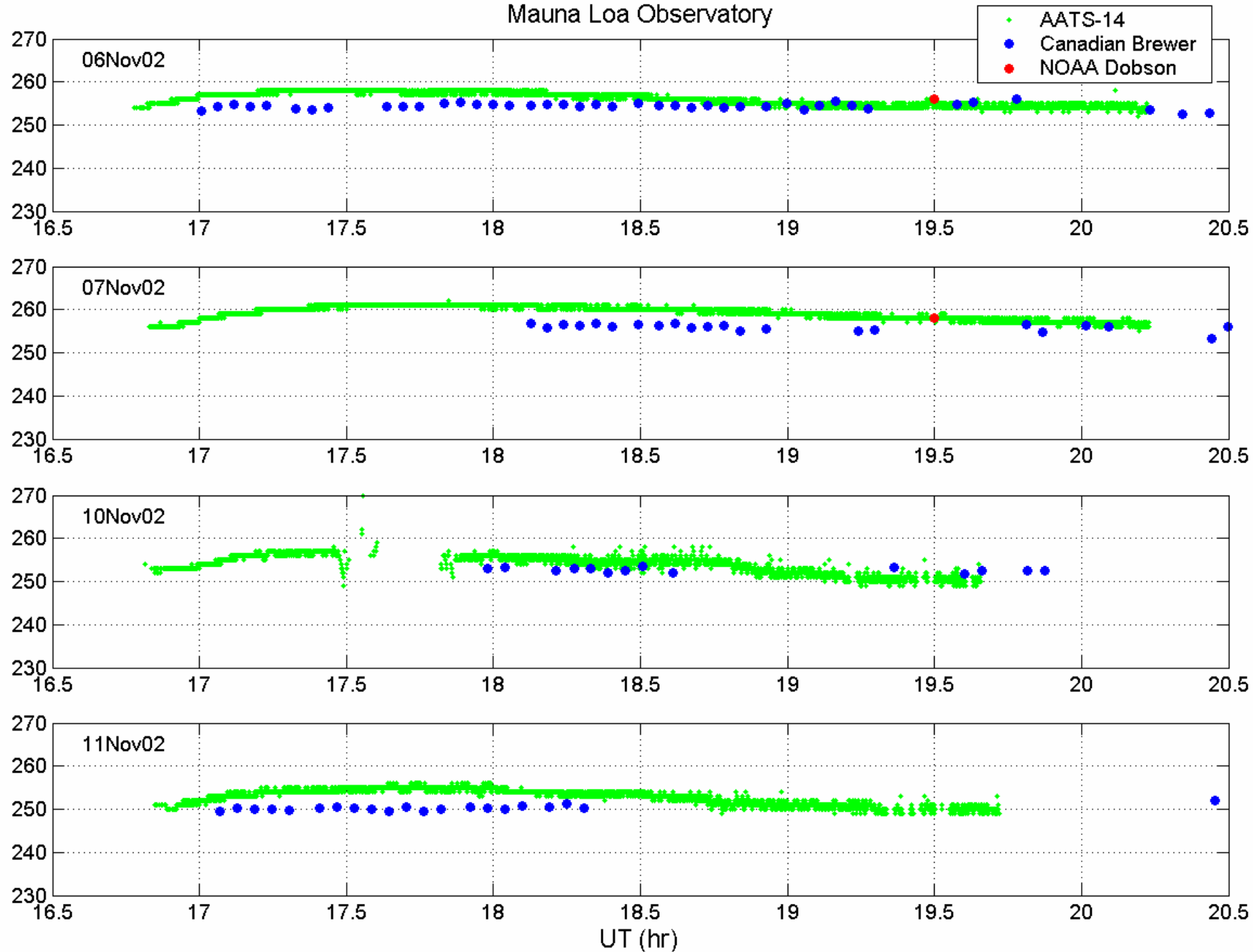
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Mauna Loa Observatory

Ozone Column Content (DU)



Brewer Data Courtesy of Ken Lamb International Ozone Service

Goals



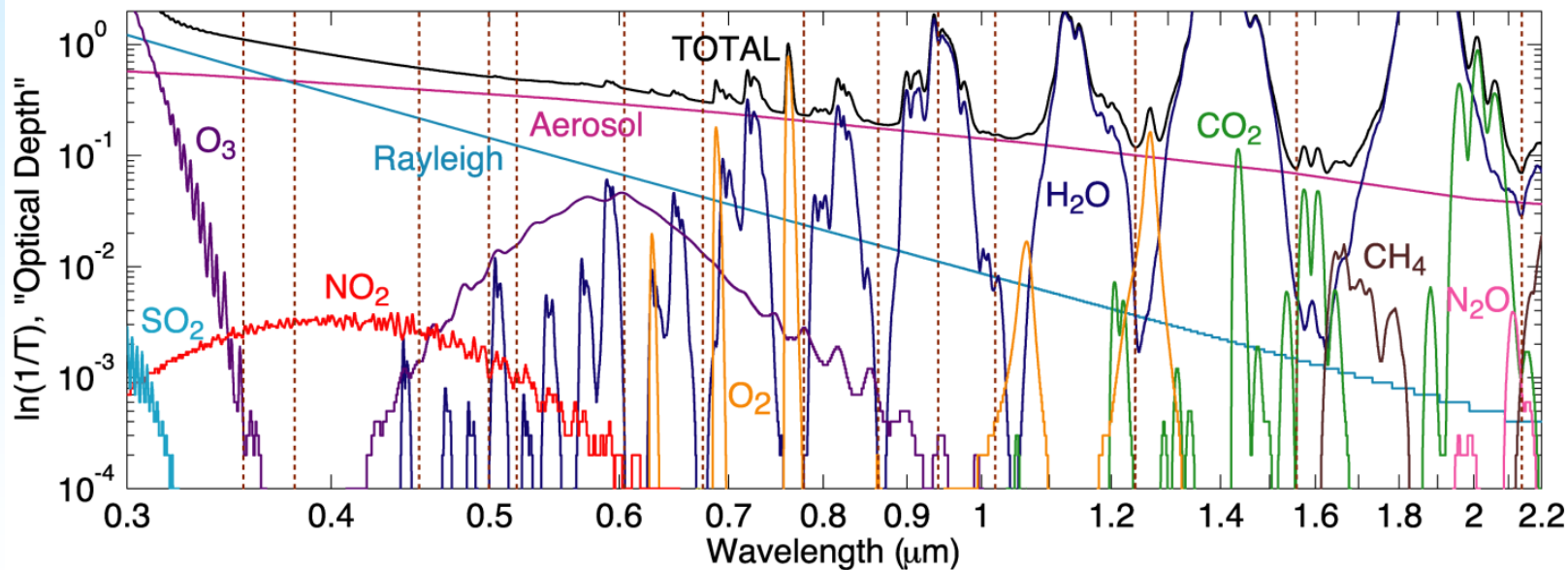
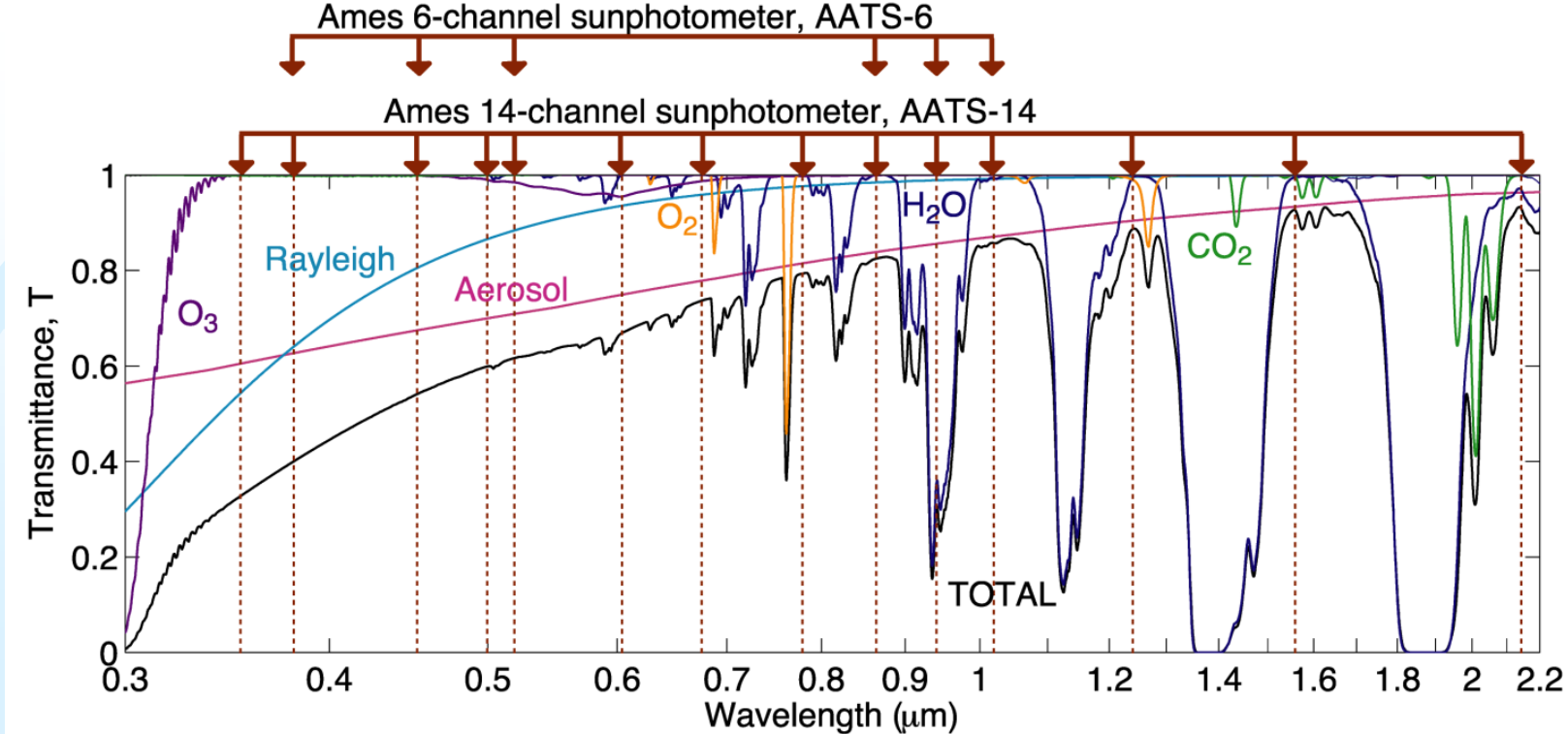
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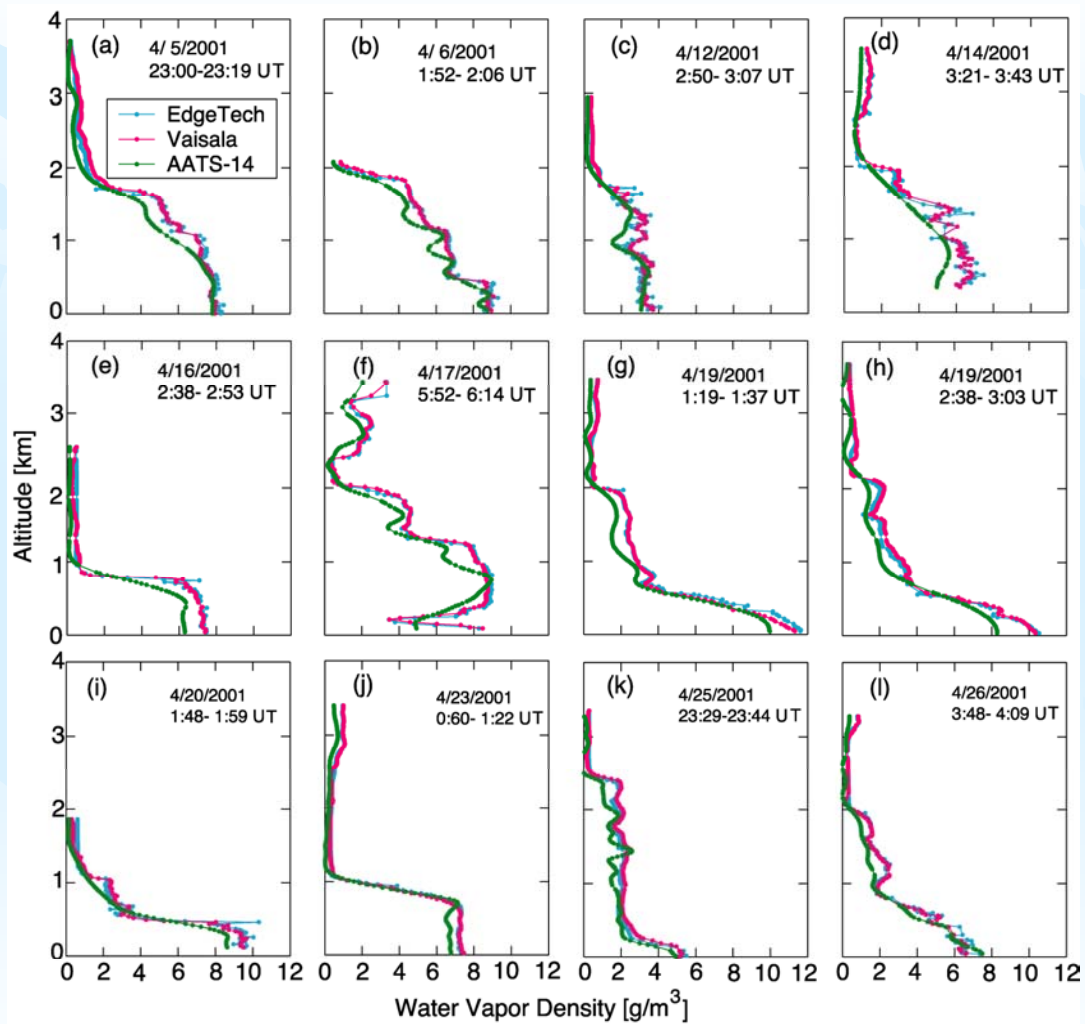
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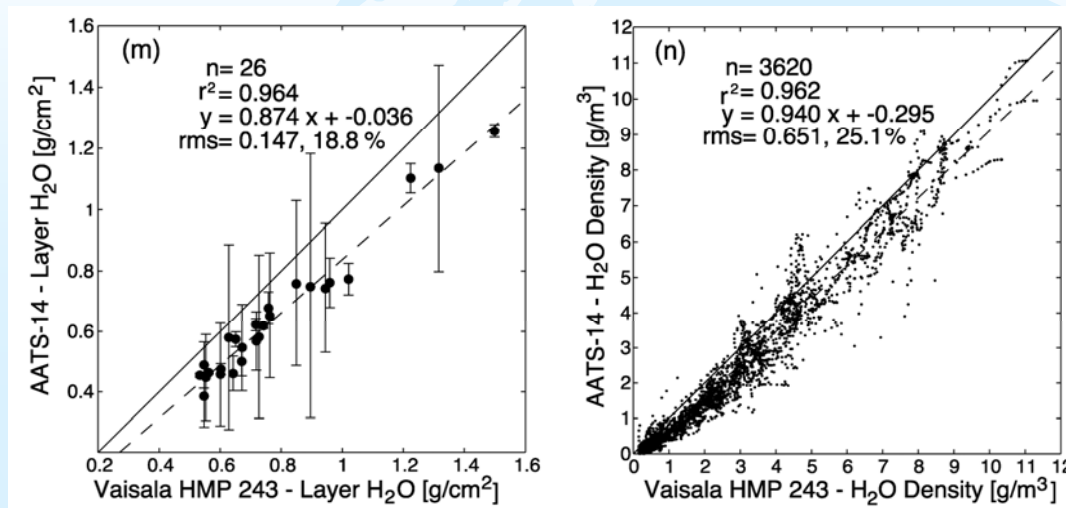
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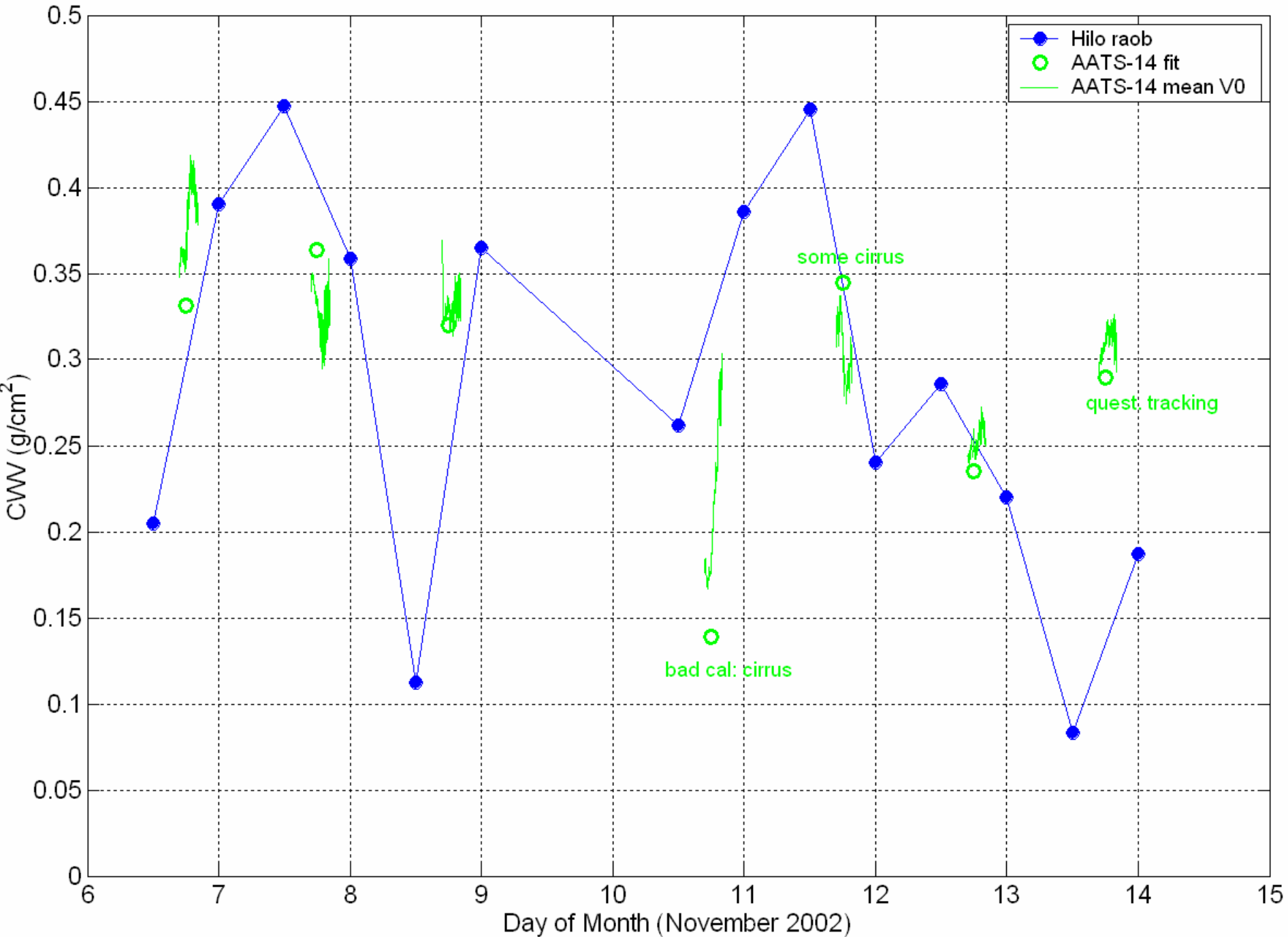
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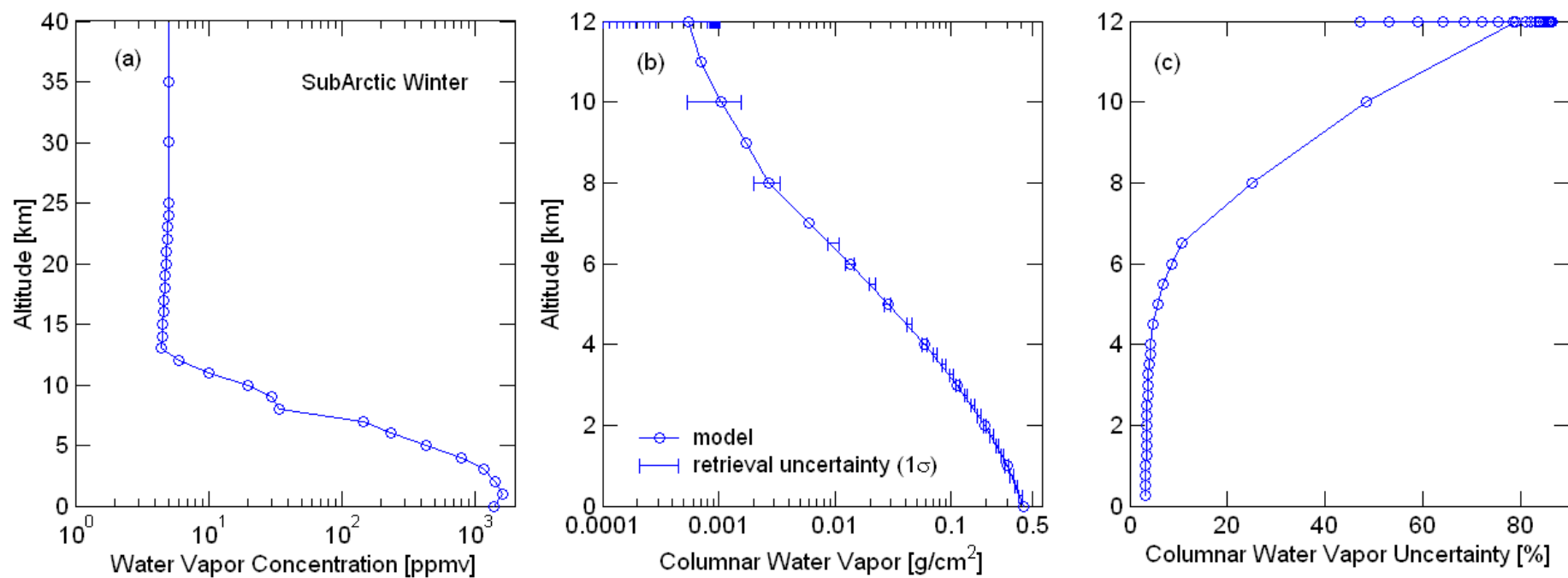






AATS-14 calibration MLO 6-13 Nov 2002





Issues



- Getting sufficient opportunities to view the sun during conditions relevant to SOLVE II science goals
 - Recommendation: For all proposed flight plans, plot sun elevation and azimuth, absolute and relative to DC-8 heading
- Viewing along SAGE III view path during SAGE III occultations:
 - Recommendation: Strong role for SAGE III reps in



Talk Content:† The talks should be about the expected science rather than the details of your particular instrument. The talks should be 12 minutes, with about 2 minutes allocated for a couple of questions.†† Talks should probably have no more than 10 vugraphs (time is tight).† The talks should contain:

- 1) A listing of your Science Team (on the introductory VG)
- 2) A basic illustration of your instrument or activity (no more than 3 VGs)



3) How does your investigation relate to the overall science goals of the mission and the Earth Science Enterprise (1 VG)?

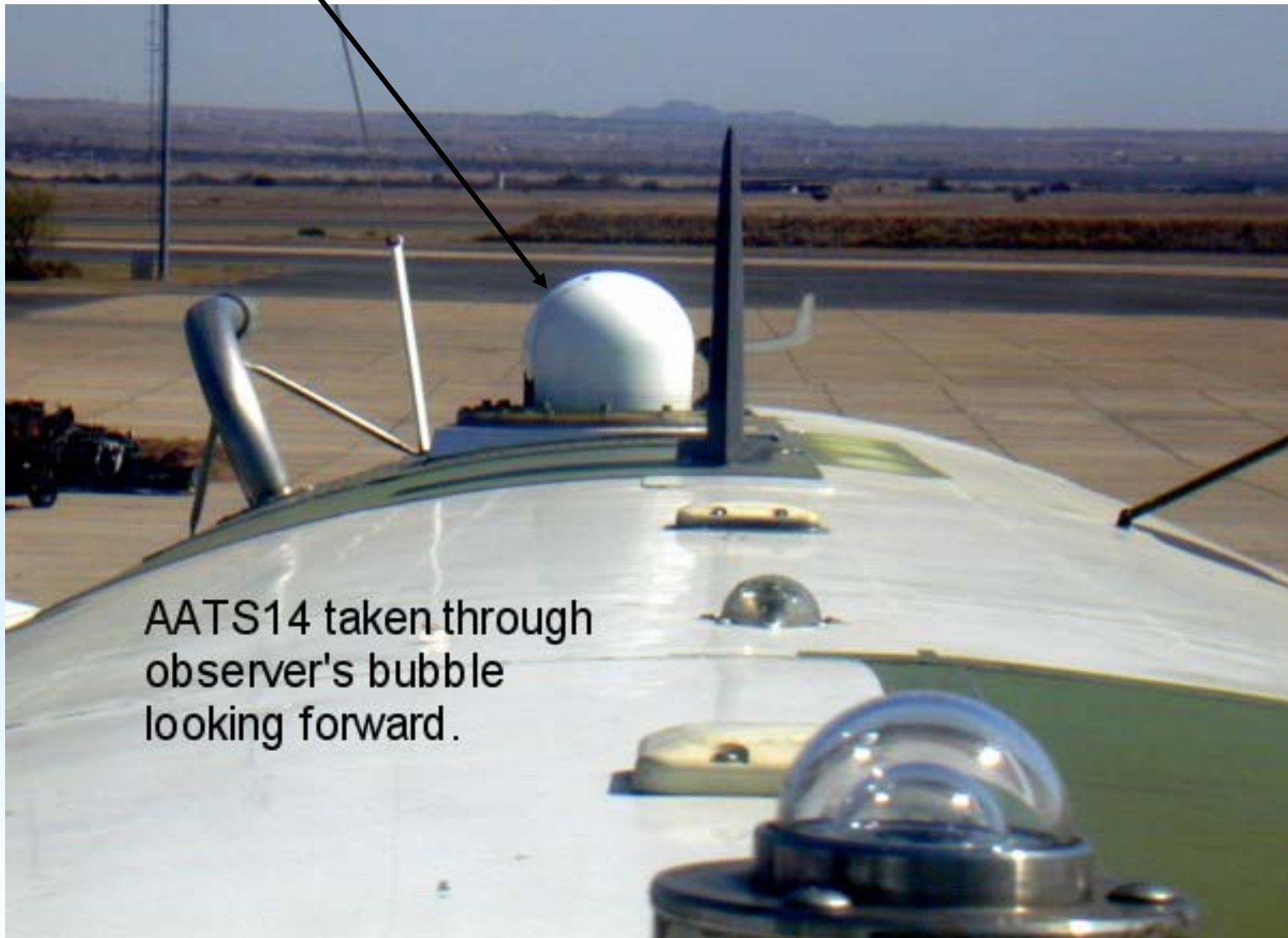
4) What sort of measurements do you expect, and what sort of science do you expect to do with your own data and the overall SOLVE II data set?

Meeting Issues:

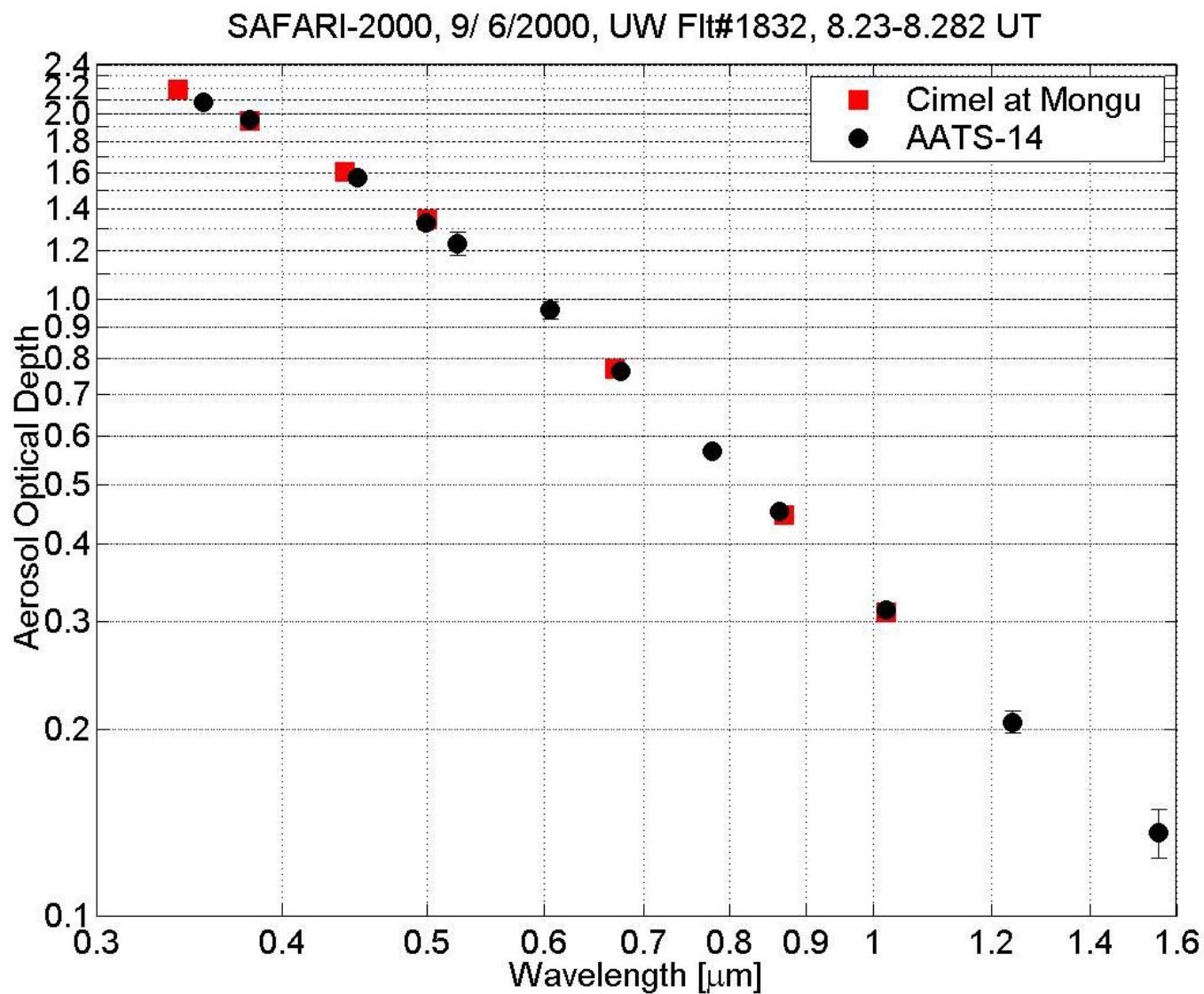
1) What major issues do you have for the project or flight operations?

2) Are there other science goals that we need to think about?

AATS-14 on UW CV-580 in SAFARI 2000

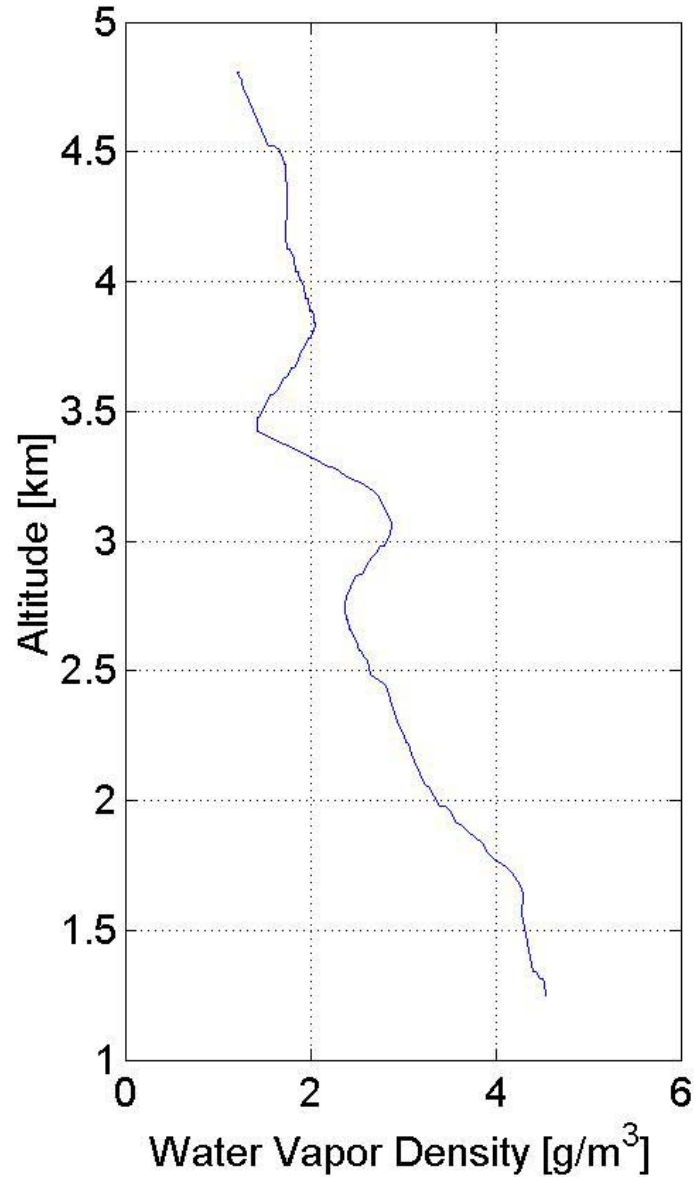
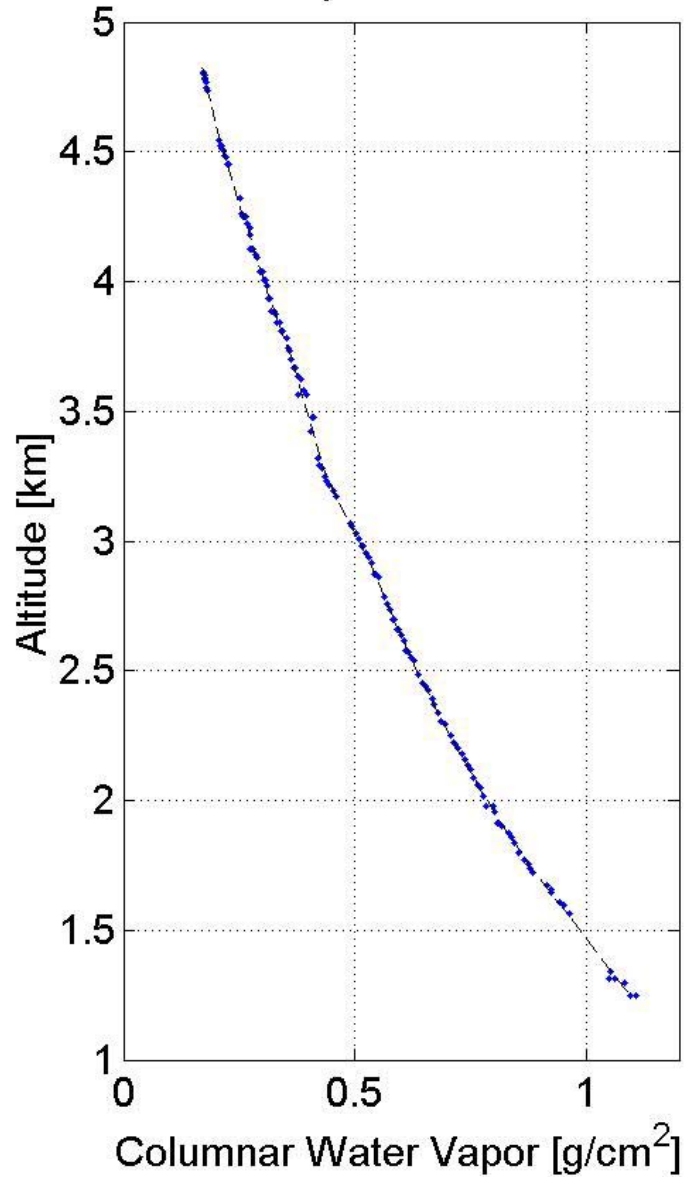


AATS14 taken through
observer's bubble
looking forward.



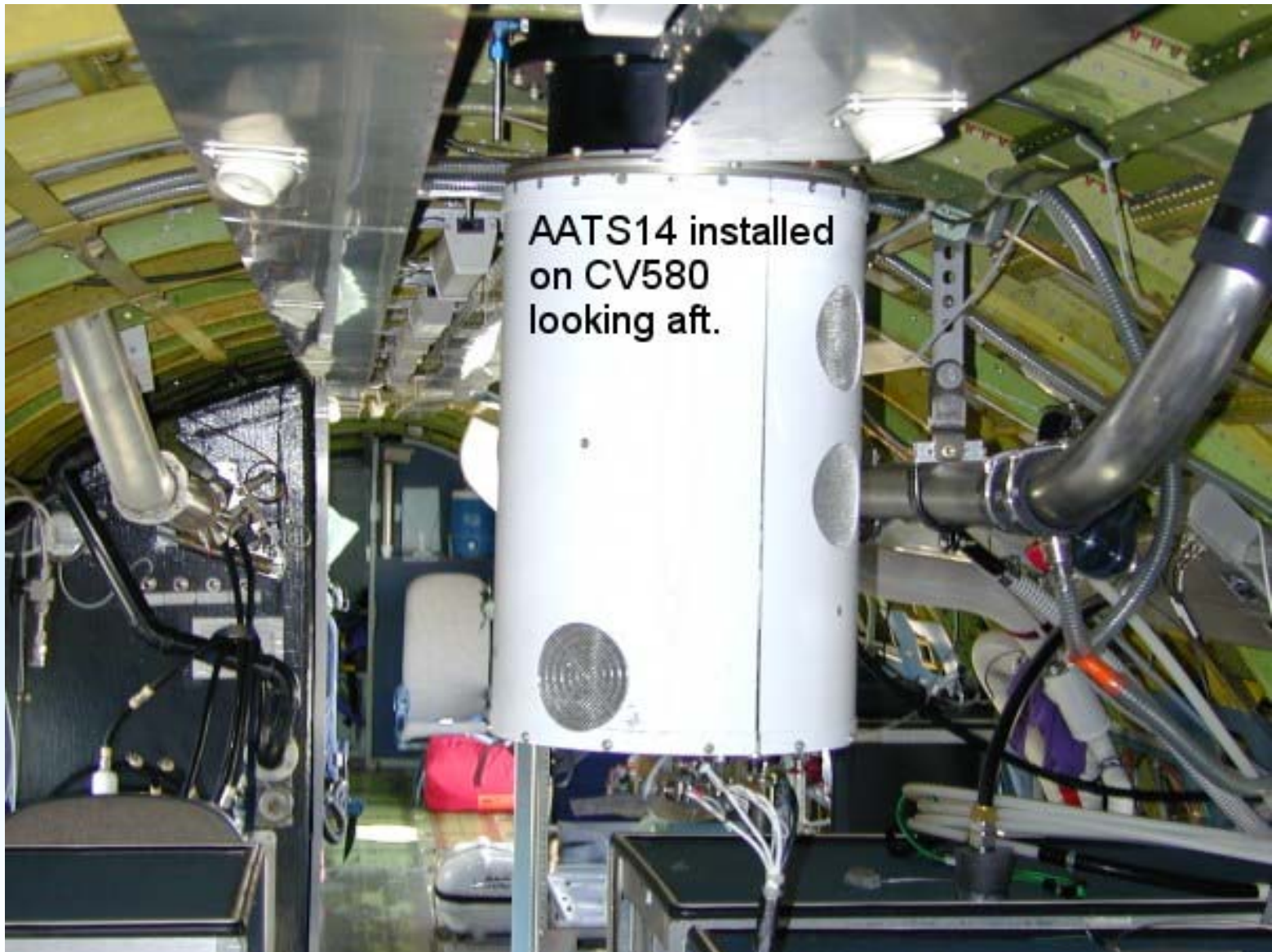
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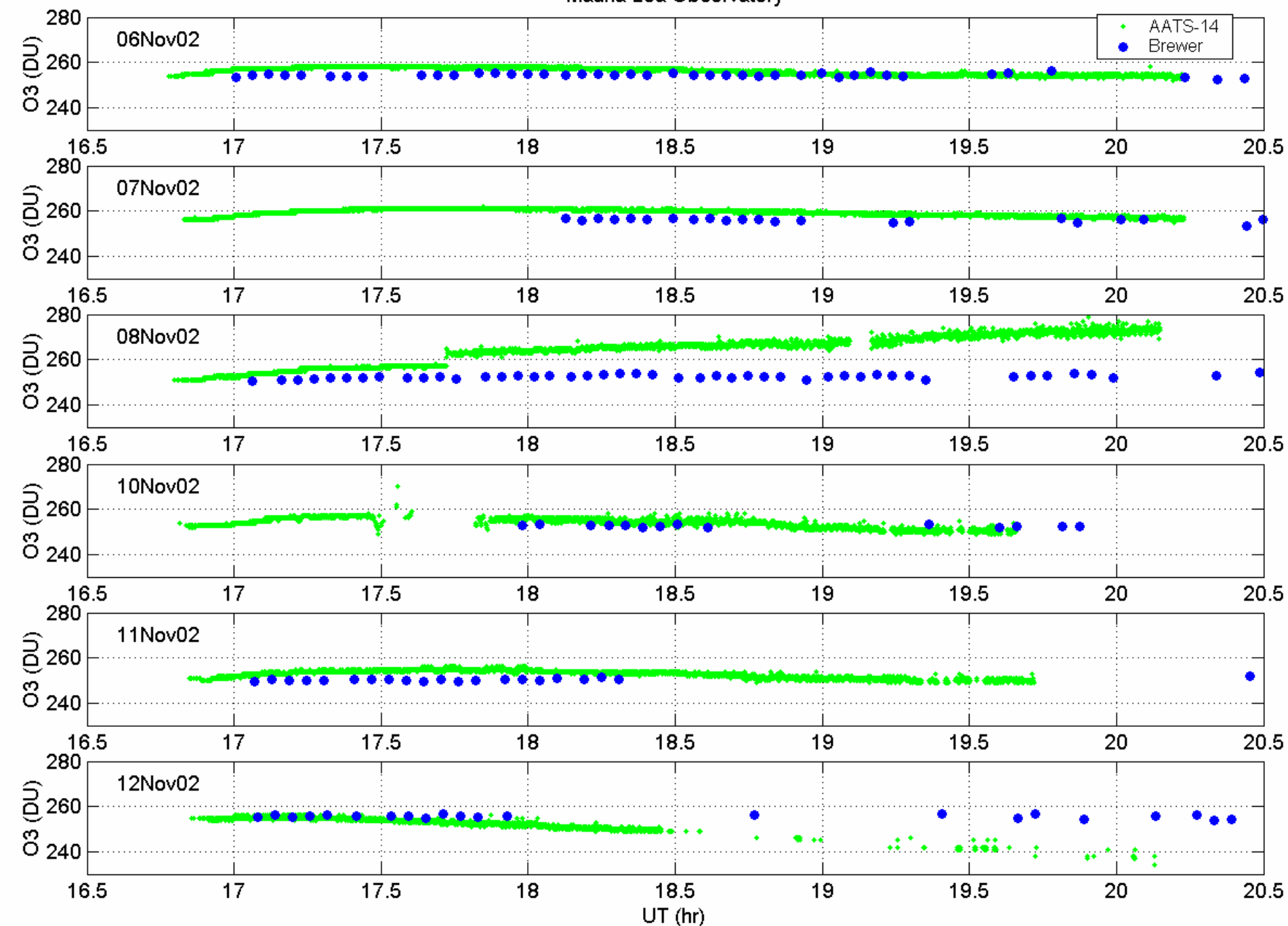


AATS14 on UW580





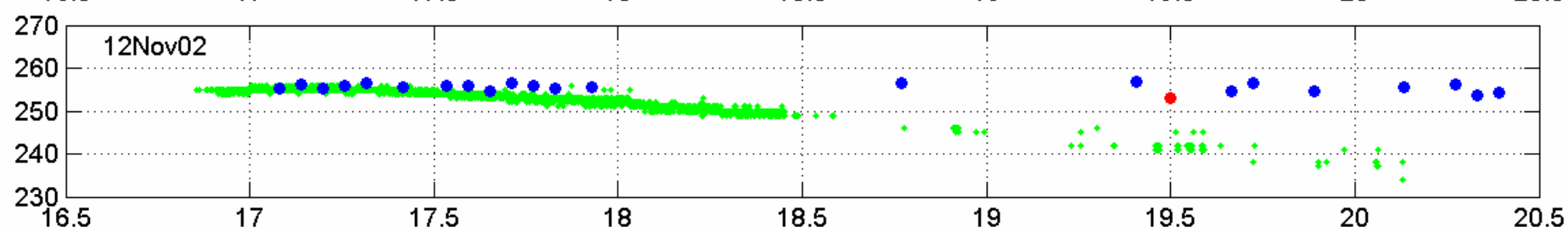
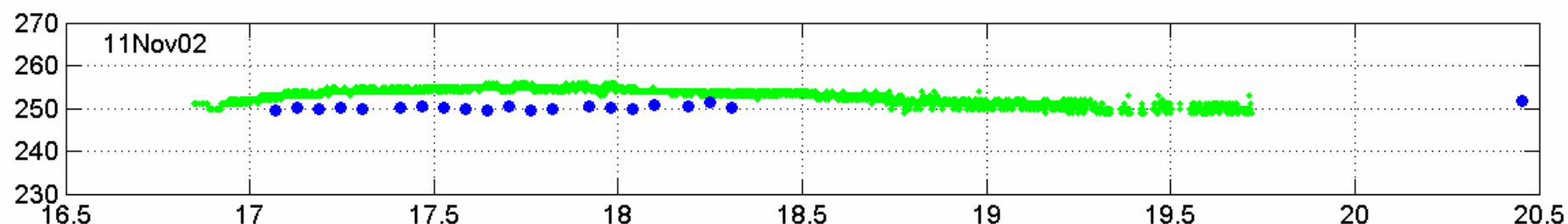
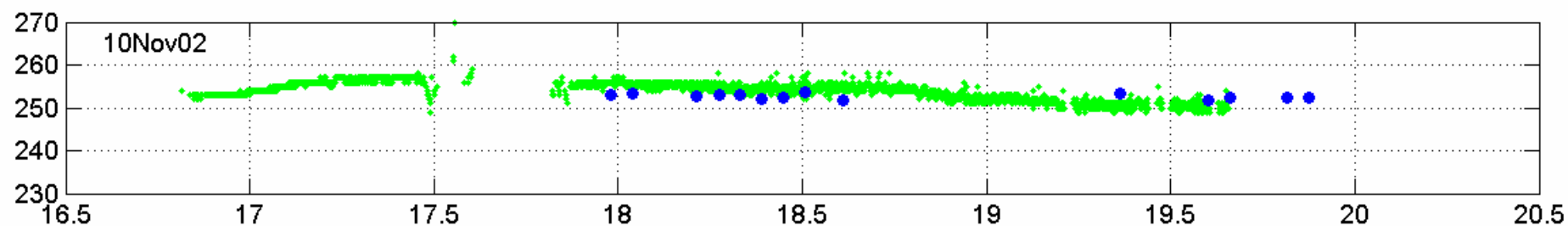
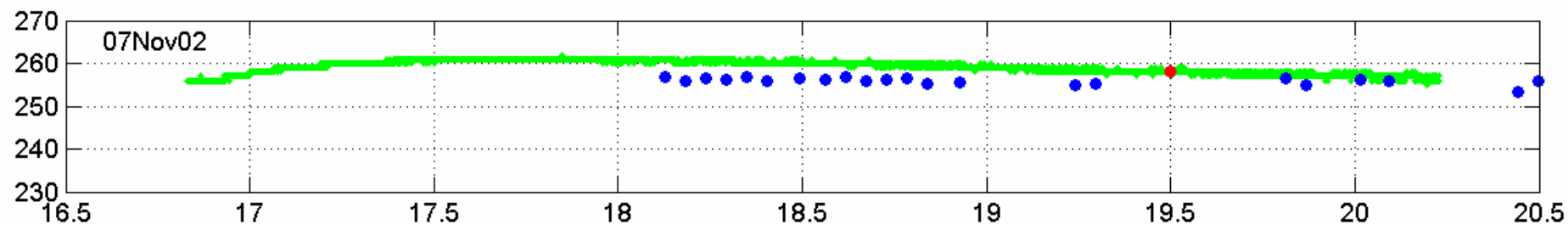
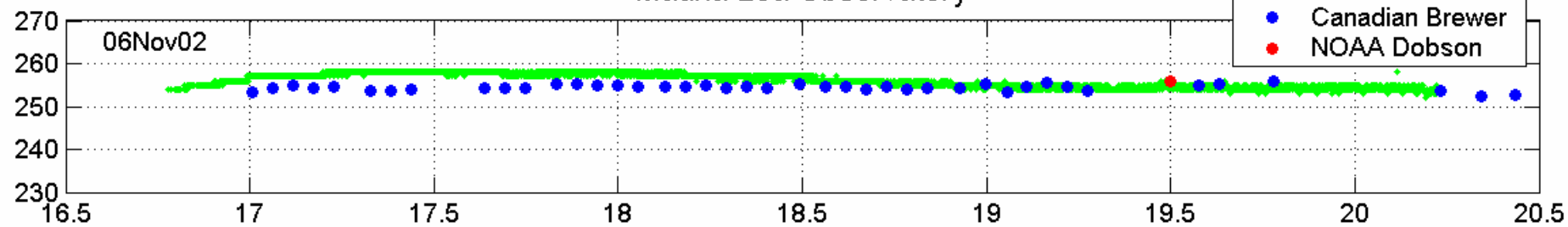
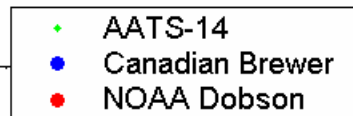
Mauna Loa Observatory



Brewer Data Courtesy of Ken Lamb, International Ozone Service

Mauna Loa Observatory

Ozone Column Content (DU)



UT (hr)

